DECLARATION

I, the undersigned Jeremy M. Topaz, a citizen of Israel residing at 8 Tor Ha-Aviv St., Rehovot, Israel, hereby declare as follows:

1. I hold a Master's degree in Electronics from the Massachusetts Institute of Technology. I am currently employed as a Senior Scientist and System Engineer at El-Op Ltd., one of the major electro-optical companies in the world. I have been and I am currently involved in the development, design, performance analysis and testing of electro-optical systems working in the visible, infrared and ultraviolet spectral regions, especially for space remote sensing and image intelligence. One of projects in which I play a major role is a UV space telescope for astronomical observation. I am familiar with the characteristics of different types of imaging sensors and with the many problems that are encountered in the implementation of electro-optical systems such as stray light, ghost images, distortion, leakage of spectral filters, transmittance limitations, etc.

   My CV is attached to this declaration as Annex A.

2. I am aware of and understand the objections of the USPTO Examiner to granting a patent on U.S. Patent Application Serial Number 09/744,148 to Elstein, et al. (referred to hereafter also as "the application"). The objection of the Examiner is based on the holding that the subject matter of the invention described in the application would have been obvious to persons skilled in the art in view of the knowledge available at the time of the invention, and particularly in view of the teachings of U.S. Patent No. 5,001,348 (referred to hereafter as "Dirscherl"), and U.S. Patent No. 5,719,567 (referred to hereafter as "Norris").

3. I have been requested by the Applicant to study and comment on the application, on US 5,001,348, on US 5,719,567, on the state of knowledge

at the time of the Applicant's invention, and on the objection of the Examiner.

4. Having read and understood the application, I learned that the object of the present invention is to provide an apparatus that will enable viewing of an image of a UV radiation emitting source in daylight, wherein this UV image is overlaid on a visible image showing the details of the background scenery in exact registration, and with no parallax. From the examples given in the application, I learned that all these features enable utilizing the apparatus in various applications, such as viewing in daylight and determining the exact location of corona that is formed on electricity transmission lines and towers, following in daylight a car which is provided with a UV emitter, etc. More particularly, I learned that the above features enable determination of the exact location of the UV image with respect to the visual scenery. From the application it is possible to learn that in the case of viewing corona discharges on high voltage transmission lines and towers in daylight, viewing of the details of the visual background and the exact registration are very essential. In my opinion these features are essential also in all the other uses of the system as described in the application.

5. From the description, and as also stated in the independent claims 1 and 8 of the application, I learned that the above objects are obtained by means of acquiring an image from the scene using two separate imaging units, a solar blind UV (SBUV) imaging unit, and a visible imaging unit. The two imaging units operate simultaneously, and they acquire their images through the same aperture and along the same optical axis. The SBUV imaging unit includes at least an SBUV filter and a UV photocathode having low or zero sensitivity in the visible region and near IR regions.

6. According to my understanding, the patent of Dirscherl discloses two embodiments, and in neither of them can a satisfactory simultaneous detection in the Solar blind UV, Visible and Infrared be performed. As indicated in col. 11 lines 1-17, the embodiment of Dirscherl shown in Fig. 7 includes a rotating filter wheel, which comprises several filters each passing a different spectral range, placed in front of a single photocathode 50 (Fig.5a and 6b). Here, clearly the detection in the various spectral ranges does not take place simultaneously, and there is a time delay between detection in the different spectral ranges. Furthermore, I learned that as this embodiment includes a single photocathode which has to respond to images in all of said spectral ranges, the photocathode must be of a wide responsive type, for example, 200-1000nm. In column 11 lines 1-3 Dirscherl confirms, and suggests using an S20 photocathode "sensitive approximately from 200nm-850nm". Known examples for such wide range photocathode are: GaAs or bi-alkali which are indeed mentioned in Dirscherl col. 6 lines 57-59. However, and as I will further elaborate hereinafter, it is not possible to provide a filter which will render the response of the combination of the photocathode and filter to be insensitive to the solar radiation and at the same time sensitive enough to detect weak UV emissions such as corona on HV lines in the solar blind band, and therefore there is no way that this arrangement will enable detection and display of a UV image of such weak sources in daylight. If, on the other hand, a photocathode that is sensitive enough in the SBUV, such as CsI, RbTe, or CsTe, is used (as discussed in col. 6, lines 55-57), the visible or IR images can not be viewed.

7. I learned that the embodiment of Fig. 11 of Dirscherl, discloses a single, multi-spectral detector using UV, IR, and visible filter coatings on a prism to separately pass the different spectral ranges to a common photocathode. As noted above, with a photocathode which would respond to all three bands such as the multi-alkali photocathode (200-1000 nm or

200-900nm) as proposed by Dirscherl, the response to weak UV emissions in the solar blind region would be swamped by the response to the intense solar radiation in the rest of the spectrum. The resulting signal-to-noise ratio would be too low to detect any weak UV emissions such as corona on HV lines in daytime. Those who are versed in the art will agree that a filter that will adequately suppress the response outside of the SBUV region with a wide-band photocathode will have extremely low transmission in the SBUV region. Dirscherl indeed discloses the possibility of viewing the UV plumes in daylight, i.e., by using a solar blind filter (See col. 2 line 46). In order to detect very weak emissions in the SBUV, other types of photocathodes have to be used, for example, CsI, RbTe, or CsTe (as mentioned also with respect to Fig. 7). However, such photocathodes are limited to a narrow band that includes the UV band, and there is no way that they can be sensitive enough in other spectral regions to simultaneously display also the IR and visual images. Therefore, I conclude that the embodiment of Fig. 11, in similarity to the one of Fig. 7, has two modes of operation as follows: (a) a first, multi-spectral mode where filters and a wide band photocathode are used, in which IR, UV, and visible images can simultaneously be obtained, but not a weak SBUV image in daylight; and (b) a single-spectrum mode where the system contains a narrow band UV photocathode and SBUV filter and which enables viewing only the image of the UV emission in daylight as well as at night, but not the IR and visible images. Furthermore, the embodiment shown in Figs. 11 and 12 of Dirscherl does not provide an overlay of the UV and visible images but only presents them side-by side in a display.

8. I will now explain why a simultaneous detection of weak UV emitting phenomena, such as plumes of short range missiles, gasoline fires, small flames and fires, corona and arcing phenomena on high voltage transmission lines, can not be performed by using a one-sensor system as taught by Dirscherl. From my knowledge, in order to detect and visualize

the above-mentioned phenomena in full daylight with solar radiation as the background, the sensor has to be absolutely blind to solar radiation.

The UV Solar blind band (240-280 nm) is unique in the solar spectrum. In this spectral range, due to absorption by the ozone layer in the atmosphere, solar radiation is completely blocked, and the background radiation at the earth's surface is zero. The zero background radiation in the solar blind band enables detection of very weak signals in the UV in full daylight. When an ideal SBUV filter is used in a sensor (optics +filter+ photocathode) to detect photons only in the UV solar blind band (240-280 nm), and to reject any photons out of the 240-280 nm band, this sensor will be absolutely solar blind, namely insensitive to solar radiation. Such a sensor will therefore be capable of detecting even weak UV emission (on or close to the earth's surface) in the solar blind band range with maximum signal-to-background noise ratio. Practically, however, as there is no ideal solar blind filter available, the filter has to be matched to the spectral response of the photocathode to such a degree that the combined (filter + photocathode) response of the detector to direct solar radiation will be at the level of the dark noise of the sensor.

From my knowledge, it is well known in the art, that an image intensified detector for detecting UV emission, in the 240-280nm spectral band, in daylight must use a combination of one of the narrow band (RbTe, CsTe or RbCsTe) UV photocathodes together with a solar blind filter, which transmits in the solar blind band (240-280nm) only and blocks the light in the mid UV, visible and near IR regions. Only such combination is known to be practical to detect such weak SBUV emissions as are described above.

The photoelectric response of the narrow band (RbTe, CsTe or RbCsTe) photocathodes is maximal at the 200-280 nm UV range. At longer

wavelength, the response of these photocathodes gradually decreases, reaching in the visible spectral range only $1x10^{-5}$ of the maximal response in the UV range. Even with such a low response in the visible range, the solar blind filter is still required to attenuate the solar radiation to the level of 12 OD (OD = Optical Density - i.e. blocking of 12 orders of magnitude) in comparison with the transmission level at the SBUV range. Such high attenuation has to be maintained throughout the 300nm to 750 nm range. Only this combination of filter and photocathode for providing an absolute solar blind sensor was known at the date of Dirscherl's patent (and this is also the case today, according to my knowledge). This implies that almost no photon emitted by the sun will be detected by the solar blind sensor.

According to my knowledge, and as far as I understand the patent of Dirscherl, the multi-spectral (Solar Blind UV, Visible and Near IR) mode of operation of the imaging units of Figs. 7 and 11 of Dirscherl requires use of a photocathode having a wide band spectral response, which is typically sensitive in the 200-900 nm range. However, with use of such a wide band photocathode, an additional attenuation of at least five orders of magnitude (i.e., up to a total 17 orders of magnitude) in the visible range is required by the optical filter in order to make the sensor absolutely solar blind. Those who are skilled in the art of optical filters know that, unfortunately, at present there is no known optical filter that complies with such requirements and provides adequate transmittance in the SBUV.

Furthermore, those skilled in the art of optical systems will be aware that stray light - unwanted light reflected from surfaces such as the walls of the optical system, lenses and the detector itself - is present in all optical systems. In the case of the embodiment proposed by Dirscherl in which a visible image reaches the same photocathode as the UV image, some of the visible light will be scattered from the photocathode

surface and fall on the UV portion of this photocathode. This light is likely to be, according to my experience of such systems with more than one spectral band on a single detector, at the very best, 6 orders of magnitude lower than the visible light, rather than the 17 orders of magnitude required to detect weak emissions in the SBUV band, so that it would completely swamp the weak SBUV signal. The only way this problem can be avoided is by having, as Elstein et al teaches, separate detectors for the SBUV and visible channels, each surrounded by a light-tight enclosure.

9. Therefore, based on the above observations, I conclude that there is no way by which Dirscherl (in his two embodiments) can be multi-spectral, and can still simultaneously detect and display a weak SBUV image in daylight, as the present application does. I also conclude that Dirscherl cannot be used for visually determining the location of the weak UV source.

10. Furthermore, I understand from the description relating to Fig. 12 that Dirscherl suggests a separate display of the various images recorded on the same photocathode. This is in contrast to the teaching of Elstein et al which teaches overlay of the UV image on the visible image and exact registration between them. In fact, in my opinion by providing a separate display of the images Dirscherl teaches away from Elstein et al invention. I also conclude, for the same reason, that the invention of Dirscherl cannot be used for the purposes that Elstein application is used (for example, to detect and locate corona on HV transmission lines).

11. I was also asked to express my opinion relating to the patent of Norris. The system of Norris acquires only the SBUV image, and does not acquire any visible image other than that seen by the operator's eyes. In other words, in Norris there is only one, SBUV, imaging unit, and not two separate units, one SBUV and the other visible, as in Elstein et al.

Norris' system does not need to acquire the visible image, as there is essentially no visual view to see due to the foggy conditions in which the system is used. In normal visibility conditions there is no need to use Norris system, and indeed Norris does not mention any such use. Therefore, in fact also Norris teaches away from the invention of Elstein et al.

12. Norris suggests (col. 8 lines 27-34) displaying the UV image (a) on a transparent head-up display, helmet-mounted sight, visor, or a device that displays the image or representation on a medium interposed between the operator's eye and his view of the actual, related scene, (b) on a monitor; or (c) integrated with the display of another sensor such as a radar display;

In all the above display forms there is no simultaneous acquiring of a UV image and a visible image of the same scene through the same aperture and along the same optical axis. Parallax is therefore unavoidable, as the visible image, if any, is acquired directly by the operator's eyes and is not combined in registration with the UV image. In fact if Norris would acquire the foggy visual scenery, this view would have been useless.

13. Therefore, the above are additional reasons why I conclude that Norris teaches away from the invention of Elstein et al. In any case, there is no interest whatsoever expressed in Norris in the visual view (which essentially does not exist). On the other hand, I learned from the invention of Elstein et al that the details of the visual scenery are very essential, as they enable the accurate determination of the location of the UV emittance.

14. As a scientist who has been actively engaged in research and development for very long time, I conclude that the Dirscherl and Norris patents either taken alone or in combination are far from providing a

solution to the problems that Elstein et al solve (for example, detecting and locating a corona on HV lines in daylight). I arrive at this conclusion, among other reasons, based on the fact that neither of them, each for his own reasons, has really considered such problems, and because neither of them has expressed an interest in the details of the background scenery. As said, in my opinion each of them in fact teaches away from the invention of Elstein et al. Even if somebody would have combined the teachings from both Dirscherl and Norris, in my opinion he would have been still far from reaching the invention of Elstein et al.

15. As far as I am familiar with the state of the art prior the filing date of the Elstein application, the invention of Elstein has provided a solution to a series of applications that could not be carried out without it. For example, the detection and location of corona on HV lines in daylight, and with a very high accuracy, could not be performed prior the date of the application. Therefore, it seems to me that the invention of this application is both novel and inventive in view of the patents of Dirscherl and Norris.

16. I hereby declare that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the subject application or any patent issuing thereon.

17. The name and signature below are my name and signature.

This 27th day of July, 2005

Jeremy M. Topaz

Curriculum Vitae, July 2005

Name: **Jeremy Topaz**

Education: M.S. in Electrical Engineering from MIT, Cambridge, MA
Thesis subject: "An opto-mechanical stylus to aid the blind in sensing images".

B.Sc (EE) Newcastle University, Newcastle, UK

Current Role Chief Scientist, Remote Sensing Operation, ELOP

Employment and experience

1989 - present **El-OP Electro-Optical Industries Ltd. Rehovot, Israel**
As a senior scientist in the Remote Sensing Operation, was involved in the design and testing of electro-optical systems for space projects and system engineer of the TAUVEX ultra-violet astronomical space telescope project. Currently function as System Engineer in a remote sensing satellite camera being developed together with CNES (French Space Research Centre) and IAI (Israel).

1988-1989 **Orbot Instruments Ltd.**
Seconded to Orbot as member of joint development team of El-Op and Orbot working on development of wafer inspection system.

!985-1988 **El-OP Electro-Optical Industries Ltd. Rehovot, Israel**
System Engineer in the Remote Sensing Operation, was involved in the design of electro-optical systems for space projects.

1983 -1985 **Ministry of Defense R & D Administration.**
On leave of absence from El-Op, responsible for the supervision of R & D projects in the field of Night Vision, Lasers and other military EO systems.

1980 - 1983 **El-Op Ltd. (After merger of RIL with El-OP)**
Head of Electronics Department of RIL Division, supervision of Development activities.

1966 - 1979 **Rehovot Instruments Ltd.**
Initially, as development engineer, was involved in development of electro-optical scientific instrumentation. Developed an electronic intruder detection system. After this, participated in a variety of innovative development programs for military applications of infra-red, in fields such as intruder detection, missile detection, thermal night vision, etc. As senior engineer, was project manager for several of these programs.

1964 - 1966 **Block Engineering, Cambridge, MA.**
Development engineer on electro-optical instrumentation projects involving Fourier and Fabry-Perot spectroscopy.

1960 - 1964 **Polaroid Corporation, Cambridge, MA**
Development of instrumentation for film and camera testing.. Development of exposure control for worlds first electronically controlled amateur camera shutter.

1956 - 1960 **Weizman Institute of Science, Rehovot, Israel**
Applied Maths Dept. Development, operation and maintenance of instrumentation for geophysical oil exploration.
Physics Dept: Development of the control system for an IR spectrometer for study of refraction in gases.

Publications

1. "Detection and Recording of Images in TAUVEX" - Jeremy Topaz, IEEE, Tel Aviv, 1992
2. "TAUVEX: UV Space Telescope" - Jeremy Topaz and Avi Huppert, SPIE 1764-09, San Diego, July 1992
3. "A fixed-focus camera objective for small remote-sensing satellites" - Jeremy M. Topaz, Ofer Braun and Dov Frieman, SPIE 1740-15, San Diego, July 1992
4. "Novel static horizon sensor for small satellites" - Jeremy Topaz and Ofer Braun, SPIE 1971-38/Optical Engineering, Tel-Aviv, Dec 1992
5. "TAUVEX UV Astronomical Telescope" - Jeremy Topaz, Ofer Braun and Noah Brosch, SPIE 1971-37/Optical Engineering, Tel-Aviv, Dec 1992
6. "Methods of autonomous correction of errors due to the variations of the IR horizon profile shape in static Earth horizon sensors" - Vladimir Alperovitch and Jeremy Topaz
7. "The TAUVEX experiment" - Noah Brosch, Amotz Shemi, Jeremy Topaz and Ofer Braun - ESA symposium on Photon Detectors for Space Instrumentation, Dec, 1992
8. "Calibration of UV imaging sensors in TAUVEX" - Ofer Braun and Jeremy Topaz, SPIE Orlando, April 1993,
9. "The TAUVEX Space Astronomy Experiment" - Noah Brosch, Amotz Shemi, Avigdor Blasberger and Jeremy Topaz- IAF Symposium, Jerusalem, 1994

Articles in magazines including “Laser Focus World”, “Military Technology” and several Israeli Publications.

Patents
Four patents in the field of Camera Exposure Control, assigned to Polaroid Corporation

Awards
“Product Design” magazine Prize for development of electronic shutter control (as part of a team at Polaroid Corporation).

Israel Defense Prize, 1972